HYDROCARBON FLUIDS PACKAGING

CROSS REFERENCE TO RELATED APPLICATIONS

[1] The present application claims the benefit of pending U.S. Provisional Patent Application Serial No. 60/454,955, filed March 13, 2003, the entire disclosure of which is hereby incorporated by reference.

FIELD OF THE INVENTION

[2] The invention relates to a packaging for hydrocarbon fluids. More particularly, the invention relates to a container having a flexible pouch within a more rigid exterior container.

BACKGROUND OF THE INVENTION

[3] Automobile service centers and other entities having a need for large volumes of hydrocarbon fluids, such as motor oil, transmission fluid or brake fluid, generally stock these materials in 55 gallon drums or 5 or 6 gallon pails or 16 gallon kegs. Each of these containers, however, present significant disadvantages. For example, the 55 gallon drums are extremely heavy and difficult to handle. Moreover, the circular shape of the drums gives rise to vacant space during transportation thereby decreasing the efficiency and raising the costs of transporting and delivering these fluids. With each of these containers, it is necessary to use a smaller container in order to dispense and use the fluid thereby creating another contaminated container.

[4] As an alternative, individual one quart plastic containers, such as those typically purchased by individual consumers, may be used by larger volume users. However, the use of individual packaging destroys the cost-savings achievable with larger volume packaging. Moreover, large volume use of individual quart bottles would unnecessarily generate large quantities of hydrocarbon-contaminated waste plastics. Finally, oil residue is left in the quart bottles and such waste could be significant when used by large volume consumers. This last disadvantage is also a problem with 5 quart bottles.

[5] There remains a need therefore for a hydrocarbon fluids container for large volume users which is economical, uses less storage space, is lighter weight and results in less waste packaging and oil.

[6] "Bag-in-a-box" containers substantially meet these needs. Most such containers utilize polymer pouches, such as polyethylene, as inner pouches which contain the liquid. Polymers which may be used as pouches for hydrocarbon fluids must have both good mechanical properties and good resistance towards hydrocarbon fluids. With the latter property there appears to be a correlation between the nature of the hydrocarbon fluid and the polymer composition. While thin polyethylene films are extremely economical, flexible and transparent and have low moisture vapor permeability, such films are permeable to oil. Increasing the thickness of the polyethylene material such that the material becomes practicably impermeable to hydrocarbons fluid is well known. However, to achieve sufficient thickness, flexibility is sacrificed and the resulting product is a rigid polyethylene container.

[7] One method to decrease the permeability of thin polyethylene films to hydrocarbon fluids involves laminating a poly-vinylidene chloride onto the polyethylene film. However, such laminates with sufficient thickness to block permeation of hydrocarbon fluids are brittle and easily ruptured. Fluorinated polyethylene films are also resistant to hydrocarbon fluids but large scale production of such material is impractical and expensive.

[8] There remains a need therefore for a hydrocarbon fluids container of the bag-in-a-box-type having a pouch constructed of an economical and hydrocarbon-resistant polymer material.

SUMMARY OF THE INVENTION

[9] The hydrocarbon fluids packaging of the invention meets these and other needs. The invention provides a "bag-in-a-box" type packaging for hydrocarbon fluids having a flexible, collapsible, sealable interior bag or pouch which prevents leakage and sweating. The hydrocarbon fluids packaging further includes a rigid container formed in a shape, such as a solid rectangle.

[10] The interior bag or pouch is constructed of a polymer laminate which is suitable for the packaging of hydrocarbon fluids which has improved hydrocarbon resistance. The polymer laminate is particularly suitable for use with automotive fluids, including for example, motor oils, automatic transmission fluids, brake fluids and lube oils. In one embodiment, the laminate comprises at least three layers having outer layers of an alkylene polymer and at least one inner layer of an oriented nylon polymer. In another embodiment, the laminate comprises at least three layers having

an inside layer of an alkylene polymer, an outer layer of an oriented nylon polymer and at least one inner layer of an oriented nylon polymer or aluminum. In another aspect of the invention, the pouch is made from a one-ply oriented and cross-linked high density polyethylene film.

BRIEF DESCRIPTION OF THE DRAWINGS

[11] Fig. 1 is a perspective exterior view of an embodiment of a hydrocarbon fluids packaging.

[12] Fig. 2 is a cross-section of an embodiment of a hydrocarbon fluids packaging.

[13] Fig. 3 is a cross-section view of a three-ply laminate of the pouch of one aspect of the invention.

[14] Fig. 4 is a cross-section view of a three-ply laminate of the pouch of an alternative aspect of the invention.

[15] Fig. 5 is a cross-section view of a single ply polymer film of the pouch of another alternative aspect of the invention.

[16] Fig. 6 is a cross-section view of a four-ply laminate of the pouch of an alternative aspect of the invention.

[17] Fig. 7 is a cross-section of another embodiment of a hydrocarbon fluids packaging.

[18] Fig. 8a depicts a perspective exterior view of another embodiment of a hydrocarbon fluids packaging where the outer flaps are open.

[19] Fig. 8b depicts a perspective exterior view of of another embodiment of a hydrocarbon fluids packaging where the outer flaps are closed.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[20] The hydrocarbon fluids packaging comprises an exterior box having sufficient rigidity to support the weight of the packaging contents as well as to withstand normal shipping and storing stacking. Disposed within the exterior box is a pouch comprised of a polymeric film which is resistant to hydrocarbon fluids, thereby preventing leakage, rupture and sweating. The hydrocarbon fluids packaging of the invention, provides for a readily portable hydrocarbon fluids, storage and transfer system. For packaging hydrocarbon fluids, it is desirable that the package be high in tensile strength, high in elongation at break, high in puncture resistance, low in oxygen transmission, low in moisture transmission, and low in coefficient of friction.

[21] Referring to Fig. 1, a perspective, exterior view of one embodiment of a hydrocarbon fluids packaging is shown. The exterior box 1 is illustrated as a solid rectangle having four side faces 2, a bottom face 3 and two opposing top flaps 4 and 5 which, when closed, form a top face 6. These flaps may or may not be interlocking but should come together to form a closed face. The exterior box may be in any shape or form as long as it is rigid enough to contain the pouch inside and be useful for protection of the pouch containing the hydrocarbon fluid and ease of transportation (rigid outer box). For example, the exterior box may be octagon, hexagon, square or rectangular. The exterior box is preferably rectangle or square for ease of construction and can be of any size useful for storage of hydrocarbon fluid and be readily portable. One or both of top flaps 4 and 5 may include an die cut or punched opening to serve as a hand hold provided the exterior box is strong enough to withstand handling stresses. In Fig. 1, only top flap 4 is shown having a handhold opening 7. Although shown in Fig. 1, a handhold is not necessary for the box and the box may or may not contain a handhold. If present, handhold is not limited to the opening shown in Fig.1 and can be in any shape or form as long as it can serve as a handhold.

[22] At least one of side faces 2 includes a valve opening 8. Each of handhold openings 7 and valve opening 8 may be entirely removed portions or alternatively, may be cut or punched so as to leave a flap along a perforation such that the flap may be folded in or out in order to create the opening.

[23] Referring to Fig. 8, a perspective, exterior view of another embodiment of a hydrocarbon fluids packaging is shown. The exterior box 10 is illustrated as a solid rectangle having four side faces (panels) 11, a bottom face 17, two opposing inner flaps 13 and 18 which, when closed, form an inner top face 70 and inner flap interface line (opening line) 16, and two opposing outer flaps 12 and 19 which, when closed, form an outer top face 71. These flaps may or may not be interlocking but should come together to form a closed face with the opposing flaps. The flaps 13 and 18, are adjacent to flaps 12 and 19 when the top face is open. The exterior box can be rectangle or square of any size useful for storage of hydrocarbon fluid and be readily portable. One or more side faces 11 may include a die cut or punched opening to serve as a handhold provided the exterior box is strong enough to withstand handling. In Fig. 10, no handhold opening is shown. The edge of the inner flap or outer flaps that meet with the opposing flaps form can be straight, curved, and/or in angles as

long as it is closes to form the top face and an opening is created that provide ready access for the pouch.

[24] One or both of top inner flaps 13 and 18 may include a die cut or punched opening to serve as opening for a valve 15. In Fig. 8, both inner top flaps 13 and 15 are shown as together having a valve opening 15. At least one of top outer flaps 12 or 19 may include a die cut or punched opening to serve as opening for a valve 14. Each of handhold openings if any and valve openings 14 and 15 may be entirely removed portions or alternatively, may be cut or punched so as to leave a flap along a perforation such that the flap may be folded in or out in order to create the opening. The valve opening 14 and 15 should be aligned in such a way that when both inner top flap and outer top flaps are closed, they are aligned to permit the pouch fitment to be inserted through both valve openings 14 and 15.

[25] Box 1 and/or 10 may be made from a unitary blank, which, in its unassembled form, lies flat or substantially flat. Alternatively, box 1 and/or 10 may be made of several separate pieces assembled and joined together to achieve the final desired form or shape. Box 1 and/or 10 may have any enclosed geometry. For convenience of transportation and storage, either a solid rectangle or cube may be used. In one aspect of the invention, box 1 has the dimensions of 11.25 by 9 by 14.25 inches, but it is one exemplary size that is convenient for a portable hydrocarbon fluid storage and any similar size that is convenient for a portable hydrocarbon fluid can be used.

[26] Materials of construction of box 1 and/or 10 may include cardboard or other cellulosic, rigid materials or foldable plastic materials. Cardboard may be corrugated. The box material may be coated and/or infused with fire-retardant and/or water-proofing additives. Examples of suitable fire-retardant coatings include, for example the intumescent coatings disclosed in U.S. Patent 3,934,066, the disclosure of which is incorporated herein by reference. Specifically, U.S. Patent 3,934,066 discloses intumescent coating compositions which include resinous or non-resinous carbonifics. Examples of resinous carbonifics include urea-formaldehyde resin, or resin forming mixtures containing an amino source such as urea, thiourea, melamine and the like; along an aliphatic aldehyde (or a source of aldehyde) such as formaldehyde, paraformaldehyde, trioxane or amethylenetetramine, acetaldehyde and the like. Examples of non-resinous carbonifics include carbohydrates such as starch, dextrin, sucrose and lactose; and polyhydroxy compounds such as glycerine, sorbitol, mannitol, pentaerythritol, dipentaerythritol and the like. The intumescent composition

may also include a spumific material which assists in the production of a thick, heat insulating carbonaceous foam. Examples of spumific compounds include mono- or di-ammonium phosphate, phosphoric acid, melamine pyrophosphate, ammonium sulfate, ammonium bromide, sodium tungstate and the like. Intumescent laminates having a porous sheet material impregnated with an intumescent coating may also be used.

[27] Other fire-retardant coatings or additives which are well known in the art may also be used, such as, for example, salt solutions. Water-proofing coatings may also be used and are also well known in the art. For example, wax coatings on cardboard containers is well known in bulk packaging of fresh fruits and vegetables. Any fire-retardant or water-proofing coating or additive appropriate to the material of construction of the box may be used.

[28] Referring to Fig. 2, a cross section of an embodiment of a hydrocarbon fluids packaging 20 is shown. The hydrocarbon fluids packaging includes an exterior box 1, a pouch 21 disposed within the box 1. The hydrocarbon fluids packaging further includes a valve opening 8 through which a fitment 22 is shown protruding. In another embodiment, fitment 22 can be a quill. The exterior box 1 can be box 10 as shown in Fig. 8. Such hydrocarbon fluids packaging further includes valve openings 14 and 15 through which a fitment 22 is protruding. The container has a valve or a quill affixed to the pouch and extending outwardly therefrom.

[29] Referring to Fig. 7, a cross section of another embodiment of a hydrocarbon fluids packaging 25 is shown. The hydrocarbon fluids packaging includes an exterior box 1, a pouch 21 disposed within the box 1. The hydrocarbon fluids packaging further includes a valve opening 8 through which a fitment 22 is shown protruding. In another embodiment, fitment 22 can be a quill. The pouch 21 further includes a filling fitment 23 that is capped once the pouch is filled with hydrocarbon fluids with a cap 24. Any commercially available cap that can fit unto the fitment and can be stable when contacted with the hydrocarbon fluid can be used to cap the pouch fitment 23. The exterior box 1 can be box 10 as shown in Fig. 8. Such hydrocarbon fluids packaging further includes valve openings 14 and 15 through which a fitment 22 is protruding. The container has a valve or a quill affixed to the pouch and extending outwardly from the valve openings. Any commercially available valve or quill that can fit unto the fitment to close the pouch fitment 22 can be used, provided such valve or quill provide the means to take out the hydrocarbon fluid and as long as they are

stable for the necessary storage time when contacted with the hydrocarbon fluid. Such valves are available, for example, from Scholle, Luquiabox, and Tomlinson.

[30] During transportation and storage of the hydrocarbon fluids packaging, the fitment may be enclosed along with the pouch within the box 1 or 10. In such manner, the hydrocarbon fluids packaging retains its regular and convenient shape during shipping and storage. For filling the pouch with fluid or for dispensing fluid from the pouch, the fitment may be passed through valve opening 8 of box 1 thereby making the fitment more easily accessible.

[31] Pouch 21 can be a polymer laminate having at least three layers comprising an outside layer of a first polyalkylene, an inside layer of a second polyalkylene, at least one middle layer between the outer layer and the inside layer of a first oriented nylon. The pouch may further have one or more other polymer layers between the outer layer and inside layer that can be, for example, another polyalkylene, another nylon, polyethylene terephthalate, ethylene vinyl alcohol, polyacetate, or aluminum. Pouch 21 can also be a polymer laminate having at least three layers comprising an outer layer of a first oriented nylon, an inside layer of a first polyalkylene, at least one middle layer between the outer layer and the inside layer of a second oriented nylon or aluminum. The pouch may further have one or more other polymer layers between the outer layer and inside layer that can be, for example, another polyalkylene, another nylon, polyethylene terephthalate, ethylene vinyl alcohol, polyacetate, or aluminum. The inside layer is in contact with the hydrocarbon fluid when pouch is filled.

[32] Referring to Fig. 3, a cross section of one embodiment of a polymer laminate used to construct the pouch 21 is shown. In one aspect of the invention, the polymer laminate is a three-ply laminate 30 comprising a first polyalkylene layer 31, an oriented nylon layer 32, and a second polyalkylene layer 33. The oriented nylon layer 32 is disposed between the first and second polyalkylene layers 31 and 33.

[33] Referring to Fig. 6, a cross section of another embodiment of a polymer laminate used to construct the pouch 21 is shown. In one aspect of the invention, the polymer laminate is a four-ply laminate 60 comprising a first polyalkylene layer 61, an oriented nylon layer 62, an ethylene vinyl alcohol polymer 63, and a second polyalkylene layer 64. The oriented nylon layer 62 and ethylene vinyl alcohol polymer layer 63 are disposed between the first and second polyalkylene layers 61 and 64.

[34] Each of the first and second polyalkylene layers 31 an 33 may be made of a polymer selected from the group of cast polypropylene, linear low density polyethylene, low density polyethylene, ultra low density polyethylene, high density polyethylene, polyethylene, polyethylene terephthalate, oriented and cross laminated high density polyethylene, a coextrusion of two different density polyethylenes, and a coextrusion of ethylene-vinyl alcohol and low-density polyethylene. First and second polyalkylene layers 31 and 33 may be unoriented, uniaxially oriented or biaxially oriented. The first and second polyalkylene layers 31 and 33 may be of the same or different polyalkylene material. Moreover, either the first or second polyalkylene layers 31 and 33 may be disposed on the interior of the pouch 21.

[35] The oriented nylon 32 may be any of the various polyamide or nylon copolymers typically used in the art of making polymeric films, such as nylon 6, nylon 6,6, nylon 6,10, nylon 11, nylon 12, nylon 6,12, amorphous nylons, partially aromatic polyamides, and copolymers of nylon. The oriented nylon layer may be either uniaxially or biaxially oriented.

[36] The outer first and inside second polyalkylene layers, 31 and 33, and oriented nylon layer 32 may be formed into a laminate using any of a number of known techniques, including application of heat and/or pressure and bonding adhesives. The thickness of the polymer laminate 30 is such as to retain flexibility. Generally, total laminate thickness may be from about 15 microns to about 300 microns. Each of the first and second polyalkylene layers, 31 and 33, may be from about 5 microns to about 225 microns thick. The oriented nylon layer 32 may be from about 5 microns to about 225 microns. Each of the total laminate and individual layer thicknesses may be smaller or larger so long as the laminate retains hydrocarbon resistance and flexibility.

[37] Other additional layers can be incorporated between the inside first and our second polyalkylene layers in addition to the oriented nylon layer 32 or 62 as long as these layers maintain the flexibility desired and the total polymer laminate thickness for the pouch. These additional layers can be, for example, another polyalkylene, another nylon, polyethylene terephthalate, ethylene vinyl alcohol polymer, polyacetate, or aluminum.

[38] In one aspect of the invention the total laminate thickness is from about 15 microns to about 260 microns, the first polyalkylene layer is from about 5 microns to about 225 microns thick, preferably to about 150 microns thick, the oriented nylon

layer thickness is from about 5 microns to about 225 microns, preferably to about 150 microns thick, and the second polyalkylene layer is from about 5 microns to about 225 microns, preferably to about 150 microns thick.

[39] The pouch 21 may be folded or formed using methods known to packaging artisans. Any sealing method providing an inner seal which is resistant to the hydrocarbon fluids. Generally, seals are formed by application, followed by removal, of heat and/or pressure which causes either or both of the polyalkylene layers along the seam line to melt and rebond so as to form a seal. Alternatively, the pouch may be sealed by use of appropriate adhesives.

[40] The pouch 21 contains at least one fitment 22 for filling and/or dispensing hydrocarbon fluids. The fitment 22 is also resistant to hydrocarbon fluids and may be made of any of a variety of suitable materials, including for example, high density polypropylene. The fitment 22 may be of any a variety of valves appropriate for the passage of hydrocarbon fluids, including viscous fluids. In addition the fitment 22 may be suitable for attaching to pumps or pump hoses. The fitment 22 may be permanently attached through an opening in the pouch using either the application of heat an/or pressure or through the use of appropriate bonding adhesives.

[41] Referring to Figure 4, another aspect of the hydrocarbon fluids packaging, pouch 21 is a three-ply polymer film 40 having a first layer 41, which is comprised of a first oriented nylon, a second layer 42, which is made of either a second oriented nylon or a thin aluminum layer, and a third layer 43 which comprises a polyalkylene.

[42] The first and second, if present, oriented nylon layers, 41 and 42, may be any of the various polyamide or nylon copolymers typically used in the art of making polymeric films, such as nylon 6, nylon 6,6, nylon 6,10, nylon 11, nylon 12, nylon 6,12, amorphous nylons, partially aromatic polyamides, and copolymers of nylon. The oriented nylon layers 41 and 42 may be either uniaxially or biaxially oriented. The oriented nylon layers 41 and 42 may be of the same or different nylon material.

[43] Where a thin aluminum layer is utilized as the second layer 42, the aluminum thickness may be from about 0.00005 to about 0.001 inches thick.

[44] Polyalkylene layer 43 may be made of a polymer selected from the group of cast polypropylene, linear low density polyethylene, low density polyethylene, ultra low density polyethylene, high density polyethylene, polyethylene, polyethylene terephthalate, oriented and cross laminated high density polyethylene, a coextrusion

of two different density polyethylenes, and a coextrusion of ethylene-vinyl alcohol and low-density polyethylene.

[45] In another aspect of the invention, the polymer laminate can be another four-ply laminate such as 60 in Fig. 6, for example, comprising a first oriented nylon layer 61, an oriented nylon layer 62, an aluminum layer 63, and a polyalkylene layer 64. The oriented nylon layer 62 and aluminum layer 63 are disposed between the first and second polyalkylene layers 61 and 64. The aluminum layer 62 can be substituted with other polymer layers such as, for example, another polyalkylene, another nylon, polyethylene terephthalate, ethylene vinyl alcohol, or polyacetate.

[46] Other additional layers can be incorporated between the inside first oriented nylon layer and outer polyalkylene layer in addition to the oriented nylon layer or aluminum layer 42 or 62 as long as these layers maintain the flexibility desired and the total polymer laminate thickness for the pouch. These additional layers can be, for example, another polyalkylene, another nylon, polyethylene terephthalate, ethylene vinyl alcohol, polyacetate, or aluminum.

[47] Any of the laminates for use in pouch 21, may be formed into a laminate using any of a number of known techniques, including application of heat and/or pressure and bonding adhesives. The thickness of the polymer laminate is such as to retain flexibility

[48] Generally, total laminate thickness may be from about 50 microns to about 300 microns. Each of the first and second polyalkylene layers, 31 and 33, may be from about 5 microns to about 225 microns thick, preferably to about 150 microns thick. The oriented nylon layer 32 may be from about 5 microns to about 225 microns, preferably to about 150 microns thick. Each of the total laminate and individual layer thicknesses may be smaller or larger so long as the laminate retains hydrocarbon resistance and flexibility.

[49] In one aspect of the invention the total laminate thickness of polymer laminate 40 is from about 15 microns to about 350 microns, preferably to about 260 microns. The first layer 41 is from about 5 microns to about 225 microns thick, preferably to about 150 microns thick, the second layer 42, where that layer is oriented nylon, is from about 5 microns to about 225 microns, preferably to about 150 microns thick, the second layer 42, where that layer is aluminum, is from about 0.00010 to about 0.00070 inches thick, and the third layer 43 is from about 5 microns to about 225 microns thick, preferably to about 150 microns thick.

[50] In yet another aspect of the invention, pouch 21 is constructed of a single layer 50 of oriented and cross-linked high density polyethylene. The thickness of the single layer 50 may be from about 50 microns to about 250 microns, preferably to about 200 microns.

[51] The pouch 21 may be placed inside (disposed) of the box 1 or 10 before filling the pouch with hydrocarbon fluids. Alternatively the pouch may be filled with the hydrocarbon fluids then placing the pouch inside of the box.

[52] While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and herein described in detail. It should be understood, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims. The present invention will be illustrated by the following illustrative embodiment, which is provided for illustration only and is not to be construed as limiting the claimed invention in any way.

Example 1

[53] Shaped and sealed pouches of at least one quart were formed of a variety of polymer laminates having the structures listed as (a)-(l) in Table 1. The first listed polymer layer constituted the exterior layer of the pouch while the last listed polymer constituted the interior layer of the pouches. The pouches were formed by heat sealing the exterior layer and each contained a permanently attached fitment through which they were filled. A pouch of each type was filled with each of 10W-30 oil and 2-cycle oil. The pouches were tested pursuant to PBI #5, Rev. 1 (1978) of the Plastic Bottle Institute. The pouches were examined for weight loss, stress cracking or rupture, and delamination. Any of (a) a weight loss of greater than ½%, (b) stress cracking or rupture, or (c) delamination results in a "Failed" rating. The results for both 10W-30 oil and 2-cycle oil are shown in Table 1. The polymeric components of the laminates are indicated by the abbreviations listed in table 2.

Table 1

	Film Material: Outside → Inside	Thickness of Film	10W-30	2 Cycle Oil
a	50μ LLDPE	50 μ	Failed	Failed
b	50μ HDPE	50μ	Failed	Failed
c	38μ PE/15.2μ BON/63.5μ PE	117μ	Passed	Passed
d	12μ PET/15μ BON/125μ LLDPE	152μ	Passed	Passed
e	12μ PET/15μ BON/80μ CPP	107μ	Passed	Passed
f	12μ PET/15μ BON/125μ LLDPE-White	152μ	Failed	Failed
g	5μ BON/25μ BON/175μ EVOH/LLPE Coextrusion	205μ	Failed	Failed
h	25μ BON/25μ BON/150μ LLDPE	200μ	Passed	Passed
i	25μ BON/25μ BON/175μ LLDPE-LDPE Coextrusion	200μ	Failed	Failed
j	60 gauge BON/0.00035 Aluminum/75μ LLDPE	(see previous column)	Passed	Passed
k	75μ OCLHDPE	75μ	Passed	Passed
l	88μ OCLHDPE	88μ	Passed	Passed

Table 2

Abbreviation	Compound
LLDPE	Linear low density polyethylene
LDPE	Low density polyethylene
ULDPE	Ultra low density polyethylene
HDPE	High density polyethylene
PE	Polyethylene
PET	Polyethylene terephthalate
BON	Biaxially oriented nylon
SBON	Silica coated biaxially oriented nylon
CPP	Cast polypropylene
EVOH	Ethylene vinyl alcohol
OCLHPE	Oriented and cross laminated high density polyethylene

Example 2

[54] Three types of individual packages were tested using Underwriter Laboratories procedure UL SU2019 (the "Pallet Fire Test"): (1) an untreated cardboard case containing standard high density polyethylene one quart bottles for passenger car motor oil ("PCMO"); (2) a hydrocarbon fluids container of the invention in which the outer box is untreated cardboard; and (3) a hydrocarbon fluids container of the invention in which the outer box is cardboard having a fire-retardant intumescent laminate coating. The one quart bottles and the pouches of each hydrocarbon fluids container were filled with PCMO. The first package, (1) above,

suffered a breach of the one quart bottles at 2 minutes and 30 seconds following lighting of the wick. The second package, (2) above, suffered a breach of the pouch at 3 minutes, 50 seconds following lighting of the wick. The third package, (3) above, incurred no breach of the pouch and the wick self extinguished twenty-one minutes after lighting.